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| CRS | NCP508 - Determine when an expression is undefined |
| Objective | <ul style="list-style-type: none"> 10.3 – Undefined rational expressions 10.4 – Identify graphs of rational and radical expressions 10.5 – Undefined radical expressions |

Mixed Review.

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|---|---|--|
| 1) If $j(x) = 3x - 1$ and $k(x) = x^2 - 5$, compute $j \circ k(x)$. $j(x^2-5) = 3(x^2-5) - 1$ $3x^2 - 16$ | 2) If $j(x) = 3x - 1$ and $k(x) = x^2 - 5$, compute $k \circ j(x)$. $k(3x-1) = (3x-1)^2 - 5$ $9x^2 - 6x + 1 - 5$ $9x^2 - 6x - 4$ | 3) If $j(x) = 3x - 1$ and $k(x) = x^2 - 5$, compute $k \circ j(-1)$. $3(-1) = 1 = -4$ $k(-4) = (-4)^2 - 5 = 16 - 5 = 11$ |
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Have students watch 4 minute clip as to WHY dividing by zero results in an answer of "undefined":

https://www.khanacademy.org/math/algebra/algebra-functions/undefined_indeterminate/v/why-dividing-by-zero-is-undefined

Directions: Write the fractions below as a decimal or an integer. Record responses in your notebook.

a. $\frac{1}{2} = .5$ b. $\frac{4}{2} = 2$ c. $\frac{0}{2} = 0$ d. $\frac{4}{0} = \text{UH.OH.}$
Error $\frac{4}{0}$

When is an expression involving a fraction undefined?
When the denominator is zero!

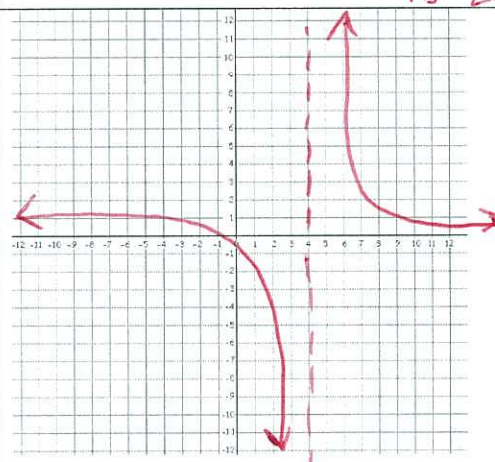
Asymptote: Lines which correspond to the zeroes (or undefined values) of the denominator of a rational function.

Example: $\frac{x}{x-4}$

be sure to include $()$ around numerator and denominator

Undefined at: $x - 4 = 0$
 $x \neq 4$

Look at your table! When $x = 4$; it reads ERROR. Notice how the graph goes toward positive and negative infinity at the asymptote, but NEVER actually hits it (at $x = 4$).



Evaluate the expressions below. Round to the nearest hundredth.

a. $\sqrt{4} = 2$ b. $\sqrt{3} = 1.73$ c. $\sqrt{0} = 0$ d. $\sqrt{-2} = \text{UH.OH.}$

When is a radical expression undefined?

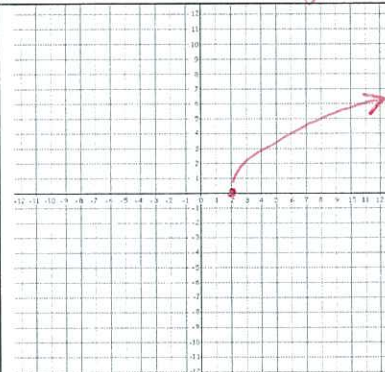
When it is ≤ 0 ; because then its imaginary.

Example: $\sqrt{4x-8}$

Undefined at: $4x - 8 < 0$
 $4x < 8$
 $x < 2$

Test: $\sqrt{4(0)-8} = \sqrt{-4} = \text{undefined}$

Look at your table! When $x = 2$; it reads ERROR. Notice that any value < 2 reads error.



PUSH IT TO THE LIMIT.

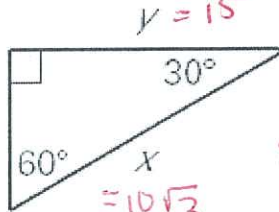
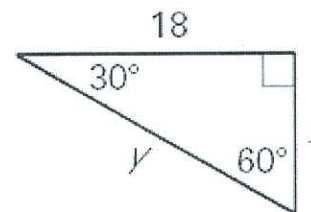
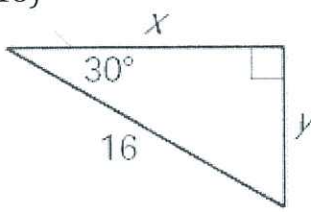
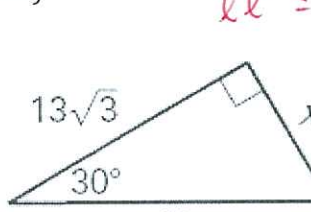
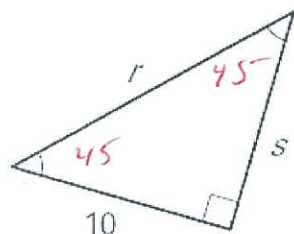
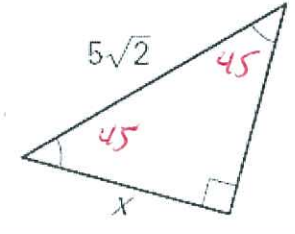
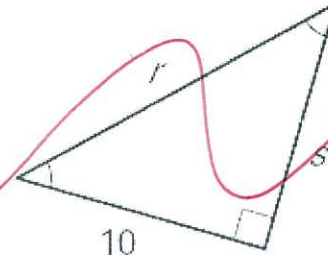
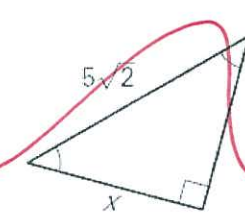
You Try!

Remember open circle for $<$ or $>$ closed is \leq or \geq !

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| <p>1) When is the following expression undefined?</p> $\sqrt{x-6}$ $x < 6$ | <p>2) When is the following expression undefined?</p> $\sqrt{3x-3}$ $3x < 3 \quad x < 1$ | <p>3) When is the following expression undefined?</p> $\sqrt{2x-10}$ $2x < 10 \quad x < 5$ |
| <p>4) When is the following expression undefined?</p> $\sqrt{2x+1}$ <p>a. $x \geq -\frac{1}{2}$ $\frac{2x}{2} < -1$</p> <p>b. $x \leq -\frac{1}{2}$ $x < -\frac{1}{2}$</p> <p>c. $x < -\frac{1}{2}$</p> <p>d. $x > -\frac{1}{2}$</p> <p>e. $x > \frac{1}{2}$</p> | <p>5) When is the following expression undefined?</p> $\sqrt{4x-16}$ <p>a. $x > \frac{1}{4}$ $4x-16 < 0$</p> <p>b. $x < -\frac{1}{4}$ $4x < 16$</p> <p>c. $x > 4$ $x < 4$</p> <p>d. $x < 4$</p> <p>e. $x > -4$</p> | <p>6) When is the following expression undefined?</p> <p>*CAREFUL! Extra step to this one... * PUSH IT!</p> $\sqrt{25-5x}$ <p>a. $x \geq \frac{1}{5}$ $25 < 5x$</p> <p>b. $x < -\frac{1}{5}$ $\frac{25}{5} < \frac{5x}{5}$</p> <p>c. $x > -\frac{1}{5}$ $5 < x$</p> <p>d. $x > 5$</p> <p>e. $x < 5$</p> |
| <p>7) When is $\frac{1}{\sqrt{3-2x}}$ defined?</p> <p>i. $x > 1.5$ ii. $x \geq 1.5$ $3-2x < 0$ $\frac{3}{2} < 2x$</p> <p>iii. $x < 1.5$ iv. $x \leq 1.5$ $1.5 < x$ $x \leq 1.5$</p> | <p>8) The expression $\sqrt{3x-12}$ is undefined for what values of x?</p> <p>a) $x = 4$ b) $x < 4$</p> <p>c) $x > 4$ d) $x \geq 4$ $3x-12 < 0$</p> <p>e) $x \leq 4$ $3x < 12$ $x < 4$</p> | <p>9) The expression $\sqrt{x-2}$ is undefined for what values of x?</p> <p>a) $x = 2$ $x-2 < 0$</p> <p>b) $x \leq 2$ $x < 2$</p> <p>c) $x \geq 2$</p> <p>d) $x < 2$</p> <p>e) $x > 2$</p> |
| <p>10) What are the excluded value(s) of the function below:</p> $\frac{28k-40}{8k-20}$ $\frac{8k=20}{8} \quad \frac{8}{8}$ $k = 5/2$ | <p>11) What is the sum of the values that make the following expression undefined?</p> $\frac{n^2-17n+70}{n^2-19n+90}$ $(n-9)(n-10)$ $n \neq 9 \quad n \neq 10 \quad 9+10 = 19$ | <p>12) When the expression $\frac{5}{x+3}$ is undefined, what is the value of $x^2 + 14x + 49$?</p> $x \neq -3$ $(-3)^2 + 14(-3) + 49$ $9 - 42 + 49 = 16$ |
| <p>13a) What is the value of x when the following expression is undefined?</p> $\frac{x+5}{5x+25}$ $x \neq -5$ <p>b) Graph to prove it!</p> | <p>14a) What is the value of x when the following expression is undefined?</p> $\frac{2-x}{3x+16}$ $x \neq -16/3$ <p>b) Graph to prove it!</p> | <p>15) State the undefined value(s) of the function:</p> $\frac{v+4}{10v+40}$ $x \neq -4$ |

PUSH IT TO THE LIMIT.

Mixed Review:

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| <p>16)</p>  <p>$y = 15$ $x = 2(5\sqrt{3}) = 10\sqrt{3}$ $SL = 5\sqrt{3}$ $y = (5\sqrt{3})(\sqrt{3}) = 15$</p> | <p>17)</p>  <p>$LL = 18$ $SL = \frac{18}{\sqrt{3}}$ $SL = x = 6\sqrt{3}$ $y = 2(6\sqrt{3}) = 12\sqrt{3}$</p> |
| <p>18)</p>  <p>$Hyp = 16 = \frac{2}{2} SL$ $SL = 8 = y$ $LL = 8\sqrt{3}$</p> | <p>19)</p>  <p>$ll = 13\sqrt{3}$ $sl = 13 = x$ $Hyp = y = 2(x) = 26$</p> |
| <p>20) Find the value of each variable. Write answers in the simplest radical form.</p>  <p>$s = 10$ $r = 10\sqrt{2}$</p> | <p>21) Find the value of each variable. Write answers in the simplest radical form.</p>  <p>$x = 5$</p> |
| <p>22) Find the value of each variable. Write answers in the simplest radical form.</p>  | <p>23) Find the value of each variable. Write answers in the simplest radical form.</p>  |
| <p>24) Let $p(x) = x^2 + x$. Find $p(p(-6))$.</p> <p>$p(-6) = (-6)^2 + (-6) = 42$ $p(42) = 1806$</p> | <p>25) Let $q(x) = 5x^2 - 4x + 3$. Find $q(q(-2))$.</p> <p>$q(-2) = 3$ $q(3) = 4684$</p> |
| <p>26) Let $f(x) = 3x - 2$ and $g(x) = \sqrt{x}$.</p> <p>a) Find $f(g(25))$. $f(5) = 13$ b) Find $g(g(1296))$. $g(36) = 6$</p> | <p>27) Let $w(x) = x^2 + 2$ and $r(x) = -\sqrt{x}$.</p> <p>a) Find $(w \circ r)(9)$. $w(-3) = 11$ b) Find $(r \circ r)(256)$. $r(16) = 4$</p> |
| <p>28) Let $f(x) = 6x + 3$, $g(x) = \frac{x+2}{5}$, and $h(x) = -7x$. Find $h(f(g(3)))$.</p> <p>$f(1) = 9$ $h(9) = -63$</p> | <p>29) Let $f(x) = 2x - 2$, $g(x) = \frac{1}{4}x$, and $h(x) = 2x$. Find $g(h(f(7)))$.</p> <p>$h(12) = 24$ $g(24) = 6$</p> |

PUSH IT TO THE LIMIT.

30) Let $k(x) = x + 2$ and $j(x) = x^2 - 0.5x - 8$.

a. Find $j(k(x))$. $j(x+2) = (x+2)^2 - 0.5(x+2) - 8$

$$x^2 + 3.5x - 5$$

b. Find $k(k(x))$.

$$k(x+2) = (x+2) + 2 = x+4$$

31) Let $f(x) = 2x^2 - 18$ and $g(x) = x - 3$.

a. Find $g \circ f(x)$.

b. Find $f \circ g(x)$.

Use the table to answer questions 32-36

| x | f(x) | g(x) |
|----|------|------|
| -4 | 2 | 3 |
| -3 | -4 | -1 |
| -2 | 0 | 1 |
| -1 | -2 | -4 |
| 0 | 1 | -3 |
| 1 | 3 | -2 |
| 2 | -1 | 4 |
| 3 | 4 | 0 |
| 4 | 3 | 2 |

32) $(f(4)) = 3$

33) $(g \circ f)(3) = 2$

34) $(f \circ f)(0) = 3$

35) $(f \circ g)(-2) = 3$

36) $(g \circ g)(-4) = 0$

ACT PROBLEMS: YOU MUST ATTEMPT EACH PROBLEM BELOW & SHOW ALL WORK!

16) Ms. McCarter wants to put carpet down in her apartment. She knows that a box of 25 carpet squares will cover 375 square feet of floor. According to these figures, what is the minimum number of boxes of 25 carpet squares needed to completely cover Ms. McCarter's apartment, which has dimensions 38 feet by 75 feet?

- A. 4
- B. 5
- C. 6
- D. 7
- E. 8

Handwritten work for problem 16:

$$38 \times 75 = 2850$$

$$2850 / 375 = 7.6$$

8 needed

17) Dominique gets a job selling magazine subscriptions over the phone, she must make 62 calls each day. Her contract states that she makes 50 cents for every call she makes and an additional 15 cents for every subscription she sells. However, she loses 20 cents for every customer she calls that does not buy a newspaper. In the last 7 days, Dominique made all of her calls and 42 customers bought newspapers while 20 did not buy newspapers. How much did Dominique earn?

Handwritten work for problem 17:

$$.5(62) + .15(x) - .20$$

$$7(.5(62)) = 217 + (42(.15)) - 7(.20)$$

$$= 233.10 - 28 = 205.10$$

18) Juan gets a job delivering pizzas, he must deliver 25 pizzas each day. Juan makes a deal with his boss that he will make 75 cents for every pizza he delivers and an additional 15 cents for every customer who calls in to give him a positive review. However, he loses 20 cents for every customer calls in to give him a negative review. In the last 7 days, Juan made all of his deliveries and 30 customers called to give him positive reviews, while 13 called to give him a negative review. How much did Juan earn?

19) Hot dogs outsell hamburgers 6 to 5. If there were 78 hot dogs sold today, how many hamburgers were sold?

PUSH IT TO THE LIMIT.